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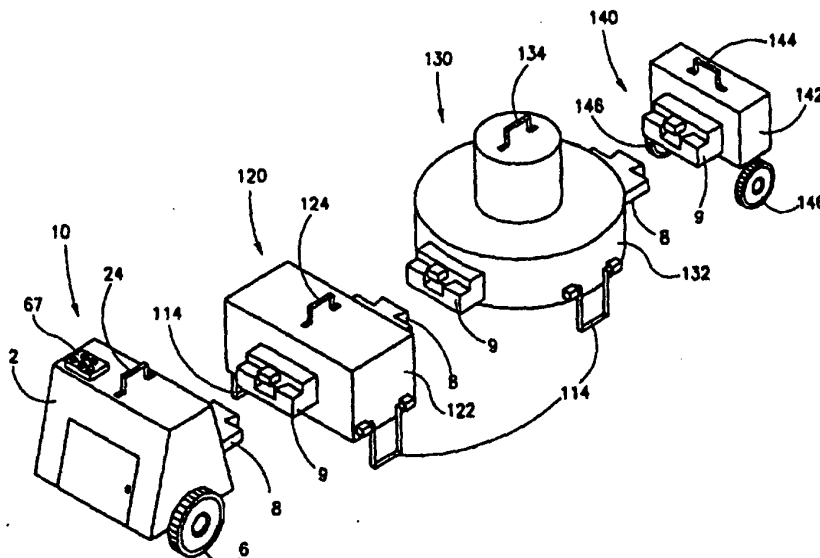
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(21) International Application Number: PCT/IL97/00200 (22) International Filing Date: 18 June 1997 (18.06.97) (30) Priority Data: 118711 23 June 1996 (23.06.96) IL (71) Applicant (for all designated States except US): FRIENDLY MACHINES LTD. [IL/IL]; Beit Ya'acobi, Ha'atzmaut Street, 40500 Even Yehuda (IL). (72) Inventors; and (75) Inventors/Applicants (for US only): LEVIN, Shalom [IL/IL]; Mishol Hagefanim Street 18, 30300 Atilit (IL). PELESS, Ehud [IL/IL]; Hatomer Street 8, 40500 Even Yehuda (IL). (74) Agent: A. TALLY EITAN-ZEEV PEARL, D. LATZER & CO.; Law Offices, Lumir House, Maskit Street 22, 46733 Herzelia (IL).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published With international search report.

(54) Title: MULTIPLE MODULE APPLIANCE



(57) Abstract

A multiple module appliance for performing routine tasks in a work area is provided. In one embodiment, the appliance includes a power module (10), at least one task module (120), and a terminal module (140). The power module (10) is separable and includes at least one battery (18). The task module (120) is separable and performs a task. The task module (120), which includes a task deck (122) and apparatus for performing a task, is connectable in series between the power module (10) and the terminal module (140) and receives power from the power module (10). More than one task module can be connected in series between the power module and the terminal module.

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MULTIPLE MODULE APPLIANCE

FIELD OF THE INVENTION

The present invention relates in general to machines for performing work
5 and more particularly to machines for performing routine house maintenance
tasks, routine agricultural tasks or routine gardening tasks, yet more particularly to
lawn mowers.

BACKGROUND OF THE INVENTION

A number of different lawn mower types have been proposed for lawn
10 mowing. Some lawn mowers are manually guided by a person during operation
while others have been proposed which are self propelled and use methods for
semiautomatic, remote controlled or fully automatic operation.

A common feature of using all lawn mowers described hereinabove is
that they often have to be manually lifted and carried a considerable distance by
15 the person operating them. This happens when there are stairs or terraces, or
rough terrain, between the storage area and the work area, as well as within the
work area itself, over which the lawn mower has to be lifted and carried.

A common disadvantage of all the above mentioned lawn mower
designs is the fact that they often contain within their structure a power source
20 such as an electrical battery , at least one motor and a mowing unit, and possibly
a collection system for collecting the grass clippings. Such lawn mowers are
heavy and difficult to lift and carry around even by a healthy adult human
operator. Indeed, in many cases, the task of lifting and carrying a lawn mower
may prove to be altogether unmanageable for the elderly, the physically
25 handicapped or for children.

An additional common disadvantage of lawn mowers is the fact that malfunction or breakage of any part in the machine, requires transportation of the entire machine for service.

Another disadvantage of lawn mowers in particular as well as in other
5 agricultural, gardening or house maintenance devices in general, is the fact that
often a particular machine is limited to the performance of a single specific type of
task. Even in cases where a machine can be used for more than one task, such
as vacuum cleaning, the collection of leaves or lawn fertilizing, this usually
involves the attachment of one or more accessories to the machine, often
10 involving mechanically linking the attachment to the machine's motor, thus
resulting in the machine becoming complicated, bulky, heavy, and often
cumbersome and difficult to operate, transport, store and maintain.

SUMMARY OF THE PRESENT INVENTION

While the present invention is particularly adapted for use as a lawn mower, certain aspects of the invention are equally applicable to other types of machines or self propelled vehicles which might have to be routinely or occasionally manually carried or positioned by a human operator within a working area. For example, the machine may be equipment for performing routine agricultural tasks, routine gardening tasks, as well as machines for household tasks, such as vacuum cleaning, floor waxing. In each machine, various different task modules for performing different tasks can be interchangeably attached to a manually propelled or self propelled power module comprising a power source. Therefore the words "lawn mower" are used hereinafter, wherever applicable, to include other types of machines operable in substantially the same manner.

The multiple module appliance of the present invention overcomes drawbacks associated with prior art appliances. Since the multiple module appliance of the present invention can be dismantled into separate modules, each separate module being lighter and smaller than the whole assembled appliance, the modules can be transported separately between the storage area and the work area. The lightness and compactness of the separate modules makes it possible for elderly or handicapped people to handle and carry the modules without excessive effort. Furthermore, the separate modules are easier to store in a limited storage space since each separate module is smaller in cross-section than the assembled multiple module appliance. Moreover the modular construction of the appliance enables the operator to mix and match different task modules in order to perform various different combinations of routine tasks.

There is therefore provided, a multiple module appliance for performing routine tasks in a work area. The appliance includes a power module, at least one task module and a terminal module. The power module is separatable and

includes at least one battery. The task module is separatable and performs a task. The task module includes a task deck and apparatus for performing a task. The task module is connectable in series between the power module and the terminal module and receives power from the power module.

5 According to one aspect of the present invention, more than one task module can be connected in series between the power module and the terminal module.

 According to a preferred embodiment of the present invention the battery of the power module is a removable battery.

10 According to another preferred embodiment of the present invention at least one of the power module the task modules and the terminal module includes a carrying handle.

 According to yet another preferred embodiment of the present invention at least one of the end modules, including the power module and the terminal
15 module, includes a device for moving along the work area.

 According to a preferred embodiment of the present invention the device includes at least one wheel rotatably coupled to the at least one of the end modules.

 According to an additional preferred embodiment of the present
20 invention, the multiple module appliance includes at least one handle attached to the power module for manual pushing and manual guiding of the multiple module appliance.

 According to a further preferred embodiment of the present invention at least one of the task modules of the multiple module appliance also includes at
25 least one foldable jack for supporting the at least one task module in the dismantled state.

There is further provided, in accordance with a preferred embodiment of the present invention a two module appliance for performing routine tasks in a work area, the appliance including a separatable power module including at least one battery, and a separatable task module, connectable to the power module,
5 the task module including a task deck and apparatus for performing a task.

According to another preferred embodiment of the two module appliance of the present invention at least one of the power module and task module also includes a carrying handle.

According to yet another preferred embodiment of the two module
10 appliance of the present invention, at least one of the power module and task module, includes a device for moving along the work area.

According to a preferred embodiment of the two module appliance of the present invention the device for moving includes at least one wheel rotatably connected to at least one of the power module and the task module.

15 According to an additional preferred embodiment of the present invention, the appliance further includes at least one sensor attached to the terminal module for providing navigation signals, at least one motor attached to the power module, the motor rotatably coupled to the device for moving, and a control unit connected to the at least one motor and to the at least one sensor for
20 providing autonomous control of the two module appliance.

Further, according to another preferred embodiment of the present invention the two module appliance further includes at least one motor attached to the power module, the motor being rotatably coupled to the device for moving, and a remote control receiver connected to the at least one motor for receiving
25 remote commands and for controlling the two module appliance, in accordance with the received commands.

Still further, according to a preferred embodiment of the present invention, the power module additionally includes a power deck, at least one motor attached to the power deck and rotatably coupled to the device for moving, for propelling the two module appliance, and at least one handle attached to the power deck for enabling manual guidance of the two module appliance, while the appliance is being propelled by the at least one motor.

According to an additional preferred embodiment of the present invention, the two module appliance includes at least one handle attached to the power deck for manual pushing and manual guiding of the two module appliance.

There is further provided, in accordance with a preferred embodiment of the present invention a power module connectable to at least one task module thereby to create a multiple module appliance, the power module including a power deck and at least one battery.

According to another preferred embodiment of the present invention, the at least one battery is a removable battery.

Still further, In accordance with another preferred embodiment of the present invention, the device for moving includes at least one wheel rotatably connected to the power deck.

According to another preferred embodiment of the present invention, the power module includes at least one motor rotatably coupled to the device for moving, at least one sensor attached to the power deck for providing navigation signals and a control unit connected to the at least one motor and to the at least one sensor, the control unit providing autonomous control of the multiple module appliance.

In accordance with yet another preferred embodiment of the present invention, the power module further includes at least one motor attached to the power deck the at least one motor being rotatably coupled to the device for

moving and a remote control receiver connected to the at least one motor for receiving remote commands and for controlling the multiple module appliance, in accordance with the received commands.

According to still another preferred embodiment of the present invention, the power module also includes at least one motor attached to the power deck and rotatably coupled to the device for moving, the motor propelling the multiple module appliance, and at least one handle attached to the power deck for enabling manual guidance of the multiple module appliance, while the appliance is being propelled by the at least one motor.

Additionally, in accordance with a preferred embodiment of the present invention, the power module includes at least one handle for manual pushing and manual guiding of the multiple module appliance.

There is further provided, in accordance with a preferred embodiment of the present invention, a task module connectable in series between two modules, the two modules selectable from the group consisting of a power module, other task modules and a terminal module, the task module including a task deck, apparatus for performing a task attached to the task deck and at least one foldable jack attached to the task deck for supporting the task module in a dismantled state.

In accordance with a preferred embodiment of the present invention, the task module also includes a carrying handle.

Finally in accordance with a preferred embodiment of the present invention, the apparatus for performing a task of the task module is selected from the group consisting of: lawn mower, lawn fertilizer, lawn seeder, grass clippings collector, dry leaves collector, vacuum cleaner, carpet washer, floor waxer and wet floor cleaner.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

5 Fig. 1 is a schematic isometric illustration of a preferred embodiment of an autonomous two module appliance in accordance with the present invention, including a power module and a lawn mowing task module;

 Fig. 2 is a schematic side view illustration of the lawn mower of Fig. 1 in the dismantled state;

10 Figs. 3A and 3B are schematic isometric illustrations, showing in detail the connectors of Fig. 1 in accordance with a preferred embodiment of the present invention;

 Fig. 4 is a schematic cross section illustration along lines IV - IV of Fig. 3A;

15 Fig. 5 is a schematic isometric illustration of the autonomous two module appliance of Fig. 1, with a lawn fertilizer task module replacing the lawn mowing task module, in accordance with a preferred embodiment of the present invention;

 Fig. 6 is a schematic front view illustration of a power module of an autonomous multiple module appliance in accordance with a preferred
20 embodiment of the present invention;

 Fig. 7 is a schematic side view illustration showing a self propelled, manually guided two module appliance in accordance with a preferred embodiment of the present invention, including a handle for guiding or manually propelling the appliance;

25 Fig. 8 is a schematic front view illustration of the power module of the two module appliance of Fig. 7;

Fig. 9 is a schematic front view illustration of a power module of a remote controlled multiple module appliance in accordance with a further preferred embodiment of the present invention;

Fig. 10 is a schematic isometric view illustration of an autonomous multiple module appliance, showing a power module, two different task modules
5 and a terminal module in the dismantled state, in accordance with a preferred embodiment of the present invention;

Fig. 11 is a perspective view illustration of the autonomous multiple module appliance of Fig. 10 in the assembled state; and

10 Fig. 12 is a side view illustration of the terminal module of the autonomous multiple module appliance of Fig. 10, showing the sensor unit thereof in detail.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

While the present invention is particularly adapted for use as a lawn mower, certain aspects of the invention are equally applicable to other types of machines or self propelled vehicles which might have to be routinely, or occasionally, manually carried or positioned by a human operator within a working area. For example, the machine may be equipment for performing routine agricultural tasks, routine gardening tasks, or household tasks, such as vacuum cleaning, wet floor cleaning or floor waxing. In each machine, various different task modules for performing different tasks can be interchangeably attached to a manually propelled or self propelled power module comprising a power source. Therefore, the words "lawn mower" are used hereinafter, wherever applicable, to include other types of machines operable in substantially the same manner.

Reference is now made to Figs. 1 and 2. Fig. 1 illustrates an autonomous two module appliance constructed and operative in accordance with a preferred embodiment of the present invention, for performing various different tasks in a work area. Fig. 2 illustrates a side view of the autonomous two module appliance of Fig. 1, shown in a dismantled state. The two module appliance includes a power module 10 and a mower module 20.

Power module 10 includes two wheels 6 rotatably connected to a power deck 2, and a male dovetail connector 8 for rigidly connecting power module 10 to mowing module 20, for supplying electrical power to the mower module and for conducting control and sensor signals between the power module 10 and the mower module 20. Power module 10 further includes a battery 18 for providing the power for propelling the two module appliance and for operating the mower module 20. Power deck 2 includes an opening closable by a cover 4 and used for inserting or removing battery 18 and for providing access to the internal parts of power deck 2. Power module 10 also includes a carrying handle 24 and a

foldable jack 14 (Fig. 2), connected to power deck 2, for supporting power module 10 in its dismantled state.

It is noted that the power module 10 of the autonomous two module appliance of Fig. 1 also includes additional parts which are not shown in Figs. 1 and 2 for the sake of clarity of illustration. These parts are described in detail and shown in Fig. 6 hereinbelow.

Mower module 20 includes a mowing deck 32, a motor 28 affixed to the mowing deck 32, and cutting means 35 suitably coupled to the motor 28. Mowing module 20 further includes two wheels or casters 12, a carrying handle 26 and a female dovetail connector 9 for connecting mowing module 20 to power module 10. Mowing module 20 still further includes a foldable jack 16 (Fig. 2), connected to mower deck 20, for supporting mowing deck 20 in its dismantled state.

Reference is now made to Figs. 3A, 3B and 4. Fig. 3A provides an isometric view of the male and female dovetail connectors 8 and 9, respectively, of Fig. 1, showing their structure in detail. Fig. 3B illustrates the bottom side of the male dovetail connector 8 of Fig. 3A. Fig. 4 illustrates a cross section of female dovetail connector 9 along line IV - IV of Fig. 3A.

The female dovetail connector 9 of Fig. 3A includes a spring loaded latch 70 used to lock the male dovetail connector 8 in place, and a male electrical plug 72, having pin contacts 76, serving to pass power and control signals from power module 10 to mower module 20. Fig. 3B shows the bottom side of the male dovetail connector 8 which includes a female electrical socket 74, having hollow contacts 78 therein for receiving pin contacts 76 of electrical plug 72.

It is noted that the pins 76 and hollow connectors 78 are connected to insulated conductive wires (not shown), passing within the dovetail connectors 9 and 8, respectively, which conduct power or control and sensor signals between the power module and the task modules.

It is also noted that although the plug 72 and the socket 74 are shown in an exemplary embodiment of the present invention to include eight pins 76 and eight hollow contacts 78, respectively, other preferred embodiments may include any suitable number of pins 76 and hollow connectors 78 necessary for
5 implementing these preferred embodiments.

Fig. 4 provides a cross section showing the details of spring loaded latch 70 which includes a spring 75 for holding the latch 70 in a locked position. Power module 10 and mower module 20 are assembled together by pressing latch 70 until it is flush with surface 77, inserting the male dovetail connector 8 into the
10 female dovetail connector 9 and sliding it downwards until latch 70 springs back to the locking position, at which stage electrical plug 72 is fully inserted into female electrical socket 74. For dismantling the lawn mower into the separate modules, latch 70 is pressed until it is flush with surface 77 and the male dovetail connector 8 is slid upwards until it disengages from female dovetail connector 9.

15 It is noted that, in accordance with a different preferred embodiment of the present invention, dovetail connectors 8 and 9 are used only for mechanically connecting the power module 10 to the task module 20, and do not include the electrical plug 76 and socket 74 shown in Figs. 3A and 3B, respectively. In this alternative embodiment the motor 28 of task module 20 and the battery 18 of
20 power module 10 are externally connected by a cable having suitable electrical connectors and including suitable wires for conducting control signals and supplying power to mower section 20 (not shown).

In accordance with a preferred embodiment of the present invention, the two module appliance can exist in two states. The first state is the assembled
25 state in which modules 10 and 20 are rigidly connected to each other by connectors 8 and 9 and the appliance is transportably supported by wheels 6 and 12. In this first state, the appliance performs a task. In the second, dismantled

state, connectors 8 and 9 are disconnected from each other and modules 10 and 20 are separated from each other and may be supported by foldable jacks 14 and 16, respectively. This arrangement has the advantage that each of modules 10 and 20 is now smaller and lighter than the whole appliance in its assembled state, thus making each of them easier to transport. A further advantage is that it may be possible to store the separate modules in a limited storage space which is too small for storing the lawn mower in its assembled state.

It is further noted that the transportation of module 10 can be further facilitated by removing battery 18 from power deck 2 and transporting each of them separately.

It is also noted that carrying handles 22, 24, and 26 are provided for manual transportation of battery 18, module 10 and module 20, respectively, by a human operator.

It is still further noted that the task module shown in Fig. 1 can be interchanged with a variety of different task modules for performing different tasks, such as lawn fertilizing, lawn seeding, collecting of dry leaves, collecting of grass clippings, vacuum cleaning, carpet washing, wet floor cleaning and floor waxing.

Reference is now made to Fig. 5 which illustrates the same power module 10 of Fig. 1 assembled together with a task module 50 for lawn fertilizing.

Lawn fertilizing module 50 includes a fertilizer deck 54, means for lawn fertilizing 57 suitably affixed within fertilizer deck 54, a pair of wheels 52 rotatably connected to fertilizer deck 54, a carrying handle 56 fixed to the top part of fertilizer deck 54, and a female dovetail connector 9, suitably affixed to the fertilizer deck 54 for connecting it to power module 10. This arrangement has the advantage that the same power module can be used for operating, powering or propelling a variety of different task modules.

It is additionally noted that in the preferred embodiment shown in Fig. 1, the two module appliance is implemented as an autonomous two module appliance, capable of automatic navigation and autonomous performing of a task in a work area as described in US Patent application 08/554,691 incorporated
5 herein by reference .

The mower module 20 of the autonomous two module appliance of Figs. 1 and 2, further includes a sensor 27 connected to mower deck 32 as best seen in Fig. 2, used for navigating as described in US patent application 08/554,691. ^{Now} _{US 6,255,793 B1}

Sensor 27 is connected to pins 76 of plug 72 by conductive isolated
10 wires 29 for conducting the sensor output signals through socket 74 of male dovetail connector 8 to control electronics 61 (best seen in Fig. 6).

Reference is now made to Fig. 6, illustrating the power module 10 of Figs. 1 and 5 in detail. Power module 10 further includes two motors 5 rotatably coupled to wheels 6 through gearboxes 7, control unit 61 connected to the motors
15 5 and to sensors 27 (best seen in Fig. 2) for motor control and navigation, and control panel 67 affixed to the top side of power deck 10 and connected to control unit 61 for operating the two module appliance.

It will be appreciated that the two module appliance described hereinabove can also be implemented using different configurations, in
20 accordance with other different preferred embodiments of the present invention, such as a manually pushed configuration, a self propelled manually guided configuration and a remote controlled configuration.

Reference is now made to Figs. 7 and 8. Fig. 7 illustrates a two module appliance having a self propelled manually guided configuration, in accordance
25 with a preferred embodiment of the present invention. Fig. 8 illustrates the power module 30 of Fig. 7 in detail.

In Figs. 7 and 8, parts having similar structure to the parts of the figures discussed hereinabove are labeled by the same reference numerals. The two module appliance includes a power module 30 for propelling the two module appliance, providing power to the task module 20 and controlling its operation and a task unit 20 for lawn mowing. Power module 30 (Fig. 8) includes a power deck 31, wheels 6 rotatably connected to power deck 31, a motor 19 affixed to power deck 31 and rotatably coupled to wheels 6 through gearbox 29 and battery 18 for supplying electrical power to motor 19 and to the motor 28 of the task module 20. Power module 30 further includes handle 34 suitably connected to power deck 31 for pushing and guiding the two module appliance. Handle 34 includes a lever 36 for manually controlling task module 20.

Reference is now made to Fig. 9, illustrating a remote controlled power module 90 constructed and operative in accordance with a further preferred embodiment of the present invention. Power module 90 includes a power deck 92, two motors 5 affixed to power deck 92 and rotatably connected to wheels 6 through gearboxes 7. Power module 90 further includes remote control circuitry panel 11 for manually or remotely controlling the power module 90. A remote control circuitry panel 11 is suitably connected to a radio frequency (RF) antenna 13 and to motor control circuitry 63. Power module 90 further includes battery 18 for supplying electric power to the motors 5 and to control circuitry 61 and remote control circuitry panel 11.

It is noted that, when the power module 90 is assembled with a task module, the resulting configuration will be a remote controlled two section appliance.

Reference is now made to Figs. 10 and 11, illustrating an additional preferred embodiment of the present invention. Fig. 10 shows an autonomous multiple module appliance, shown dismantled, including the power module 10

described hereinabove, two task modules 120 and 130, and a terminal module 140.

Fig. 11 shows the multiple module appliance of Fig. 10, in the assembled state. It is noted that, in the assembled state, after the proper
5 connectors 8 and 9 has been connected, the operator folds the foldable jacks 114 of task modules 120 and 130 upwards, thus enabling wheels 6 and 146 to transportably support the multiple module appliance during its operation.

Task module 120 is a lawn fertilizing module including a fertilizer deck 122, a carrying handle 124 attached to deck 122, means for lawn fertilizing 125
10 suitably affixed within deck 122, two foldable jacks 114 attached to deck 122, for supporting task module 120 in the dismantled state, and two dovetail connectors 8 and 9, rigidly attached on opposite sides of deck 122, for connecting task module 120 to power module 10 and task module 130.

Task module 130 is a lawn mowing module including a mowing deck
15 132, a carrying handle 134 attached to deck 132, means for lawn mowing 135 suitably affixed within deck 132, two foldable jacks 114 attached to deck 132 for supporting task module 130 in the dismantled state and two dovetail connectors, rigidly attached on opposite sides of deck 132 for connecting task module 132 with task module 120 and terminal module 140.

20 It is noted that, in accordance with the preferred embodiment of the present invention shown in Figs. 10 and 11, task modules 120 and 130, each include a male and a female dovetail connector affixed to opposite sides of the module. The power module includes a single male dovetail connector and the terminal module includes a single female dovetail connector, thus one or more
25 task modules can be connected between the power module and the terminal module by connecting and locking the appropriate male and female dovetail connectors of the different modules

Reference is now made to Fig. 12 which illustrates terminal module 140, in a side view. Terminal module 140 includes a terminal deck 142, a carrying handle 144, two wheels or casters 146 rotatably affixed to deck 142 for transportably supporting the multiple module appliance in its assembled state and
5 a dovetail connector 9 for connecting terminal module 140 to task module 130.

Terminal module 140 also includes sensor 145 for providing navigation signals as described in US patent application 08/554,691. Sensor 145 is connected to pins 76 of plug 72 by conductive isolated wires 147.

It is noted that, while the exemplary embodiment shown in Fig. 8
10 includes two task modules, a different number of task modules can be included as necessary. For example, the appliance may include a power module, a mowing module and a terminal module, thus operating as a lawn mower, or it may include a power module, a mower module, a fertilizer module and a module for collecting grass clippings, thus operating as a mower-collector-fertilizer combination,
15 performing all these tasks simultaneously.

It is further noted that the multiple module appliance shown in Figs. 10 and 11 is configured as an autonomous multiple module appliance. In accordance with other preferred embodiments of the present invention, the multiple module appliance can be constructed in different configurations such as a
20 manually propelled manually guided configuration, a self propelled manually guided configuration and a remote controlled configuration, by assembling the different power sections described hereinabove with the appropriate task units and terminal section.

It is still further noted that, in all of the different preferred embodiments of
25 the two module appliance or the multiple module appliance described and shown hereinabove, all the dovetail connectors of the female type can be replaced with connectors of the male type and vice versa, as long as this is done consistently

for all the modules of the appliances described hereinabove (i.e. as long as the polarity of the connections is conserved).

It is also noted that while some preferred embodiments of the present invention include wheels for moving the multiple module appliance in the work area, the wheels can be replaced by other suitable devices such as casters or caterpillar treads.

It is finally noted that, while the connectors in the different exemplary embodiments of the present invention, shown and described hereinabove, are dovetail connectors, other types of suitable connectors may be used for connecting the modules.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined only by the claims which follow:

CLAIMS

1. A multiple module appliance for performing routine tasks in a work area, the appliance comprising:
 - a. a separatable power module comprising at least one
5 battery;
 - b. a separatable terminal module; and
 - c. at least one separatable task module, for performing a task,
said task module comprising:
 - i. a task deck; and
 - 10 ii. means for performing a task attached to said task
deck,said at least one task module being connectable in series between
said power module and said terminal module, said at least one
task module receiving power from said power module.
- 15 2. The multiple module appliance according to claim 1, wherein said
battery is a removable battery.
3. The multiple module appliance according to claim 1, wherein at
least one of said power module, task module and terminal module
also comprises a carrying handle.
- 20 4. The multiple module appliance according to claim 1, wherein at
least one end module, comprised of said power module and said
terminal module, additionally comprises means for moving along
the work area.

5. The multiple module appliance according to claim 4, wherein said means for moving comprises at least one wheel rotatably connected to at least one of said end modules.
6. The multiple module appliance according to claim 4, further comprising:
- 5 a. at least one sensor attached to said terminal module for providing navigation signals;
- b. at least one motor attached to said power module, said at least one motor rotatably coupled to said means for moving;
- 10 and
- c. a control unit connected to said at least one motor and to said at least one sensor for providing autonomous control of said multiple module appliance.
7. The multiple module appliance according to claim 4, further comprising:
- 15 a. at least one motor attached to said power module, said motor being rotatably coupled to said means for moving;
- b. a remote control receiver connected to said at least one motor, for receiving remote commands and for controlling
- 20 said multiple module appliance, in accordance with the received commands.
8. The multiple module appliance according to claim 4, wherein said power module additionally comprises:
- a. a power deck;

- b. at least one motor attached to said power deck and rotatably coupled to said means for moving for propelling said multiple module appliance; and
 - c. at least one handle attached to said power deck for enabling manual guidance of said multiple module appliance, while said appliance is being propelled by said at least one motor.
- 9. The multiple module appliance according to claim 4 further comprising at least one handle attached to said power module for manual pushing and manual guiding of said multiple module appliance.
- 10. The multiple module appliance according to any of claims 1 - 9, wherein said means for performing a task is selected from the group consisting of: lawn mower, lawn fertilizer, lawn seeder, grass clippings collector, dry leaves collector, vacuum cleaner, carpet washer, floor waxer and wet floor cleaner.
- 11. The multiple module appliance according to claim 1, wherein at least one of said task modules also comprises at least one foldable jack for supporting said at least one task module in the dismantled state.
- 12. A two module appliance for performing routine tasks in a work area, the appliance comprising:
 - a. a separatable power module comprising at least one battery; and
 - b. a separatable task module, connectable to said power module for performing a task, said task module comprising:

- i. a task deck; and
- ii. means for performing a task attached to said task deck.

- 5 13. The two module appliance according to claim 12, wherein at least one of said power module and task module also comprises a carrying handle.
14. The two module appliance according to claim 12, wherein at least one of said power module and task module, additionally comprises means for moving along the work area.
- 10 15. The two module appliance according to claim 14, wherein said means for moving comprises at least one wheel rotatably connected to at least one of said power module and task module.
16. The two module appliance according to claim 14, further comprising:
- 15 a. at least one sensor attached to said task module for providing navigation signals;
- b. at least one motor attached to said power module, said at least one motor rotatably coupled to said means for moving; and
- 20 c. a control unit connected to said at least one motor and to said at least one sensor for providing autonomous control of said two module appliance.
17. The two module appliance according to claim 14, further comprising:

- a. at least one motor attached to said power module, said motor being rotatably coupled to said means for moving; and
 - b. a remote control receiver connected to said at least one motor, for receiving remote commands and for controlling said two module appliance, in accordance with the received commands.
- 5
18. The two module appliance according to claim 14, wherein said power module additionally comprises:
- a. a power deck;
 - b. at least one motor attached to said power deck and rotatably coupled to said means for moving for propelling said two module appliance; and
 - c. at least one handle attached to said power deck for enabling manual guidance of said two module appliance, while said appliance is being propelled by said at least one motor.
- 10
- 15
19. The two module appliance according to claim 14 further comprising at least one handle attached to said power deck for manual pushing and manual guiding of said two module appliance.
- 20
20. The two module appliance according to any of claims 12 - 19, wherein said means for performing a task is selected from the group consisting of: lawn mower, lawn fertilizer, lawn seeder, grass clippings collector, dry leaves collector, vacuum cleaner, carpet washer, floor waxer and wet floor cleaner.
- 25

21. A power module connectable to at least one task module thereby to create a multiple module appliance, the power module comprising;
- a. a power deck; and
- 5 b. at least one battery.
22. The power module according to claim 21, also comprising a carrying handle.
23. The power module according to claim 21, additionally comprising means for moving along the work area.
- 10 24. The power module according to claim 23, wherein said means for moving comprises at least one wheel rotatably connected to said power deck.
25. The power module according to claim 23, further comprising:
- a. at least one motor attached to said power deck, said at
- 15 least one motor being rotatably coupled to said means for moving;
- b. at least one sensor attached to said power deck for providing navigation signals; and
- c. a control unit connected to said at least one motor and to at
- 20 least one sensor, the control unit providing autonomous control of said multiple module appliance.
26. The power module according to claim 23, further comprising:
- a. at least one motor attached to said power deck, said at
- least one motor being rotatably coupled to said means for
- 25 moving; and

- b. a remote control receiver connected to said at least one motor, for receiving remote commands and for controlling said multiple module appliance, in accordance with the received commands.

5 27. The power module according to claim 23 additionally comprising:

- a. at least one motor attached to said power deck and rotatably coupled to said means for moving for propelling said multiple module appliance; and
- b. at least one handle attached to said power deck for
10 enabling manual guidance of said multiple module appliance, while said appliance is being propelled by said at least one motor.

28. The power module according to claim 23, further comprising at least one handle for manual pushing and manual guiding of said
15 multiple module appliance.

29. A task module connectable in series between two modules, the two modules selectable from the group consisting of a power module, other task modules and a terminal module, the task module comprising:

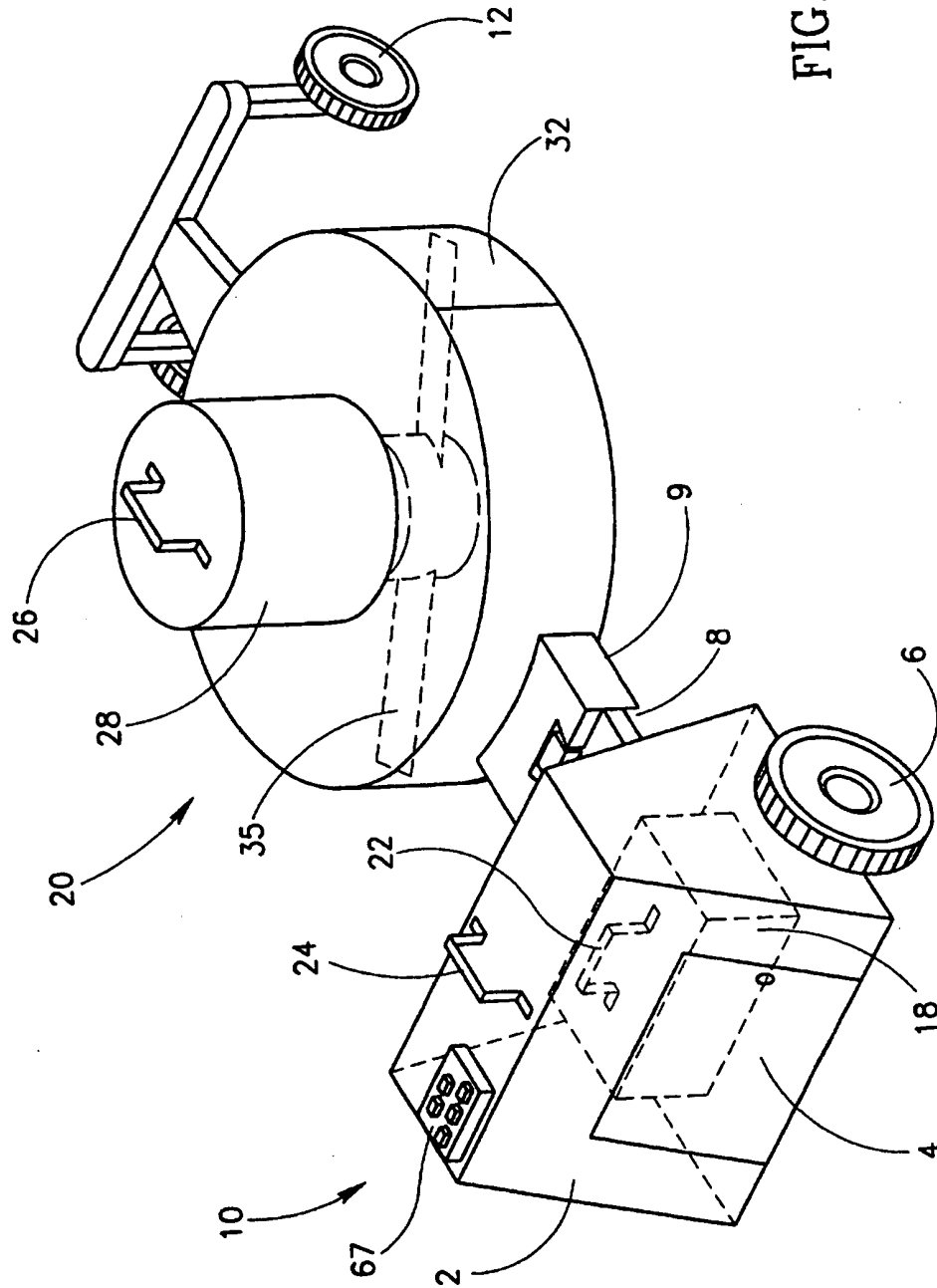
- 20 a. a task deck;
- b. means for performing a task attached to said task deck; and
- c. at least one foldable jack attached to said task deck for supporting said task module in a dismantled state.

30. The task module according to claim 29, further comprising a
25 carrying handle.

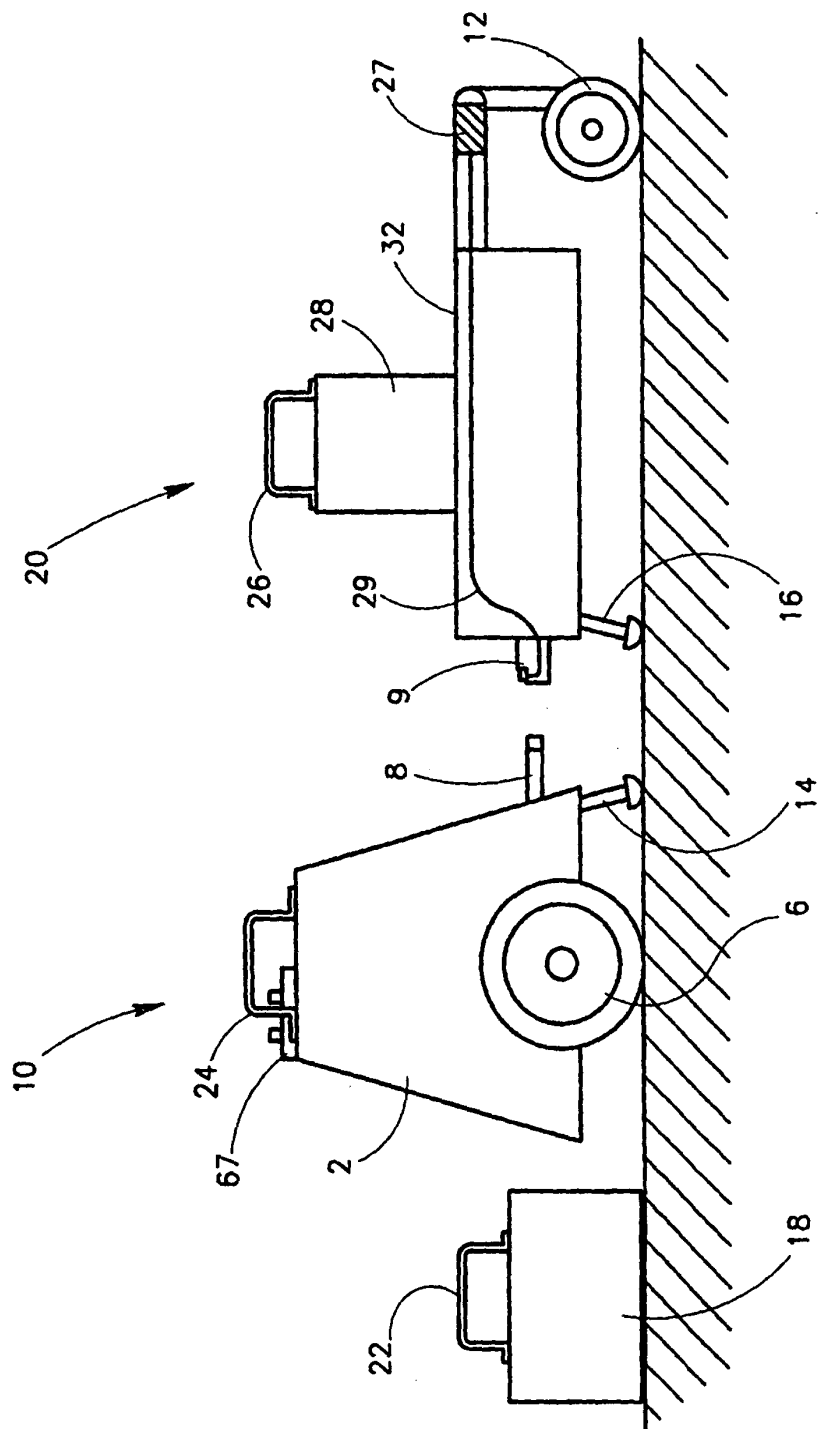
31. The task module of claim 29, wherein said means for performing a task is select d from the group consisting of: lawn mower, lawn fertilizer, lawn seeder, grass clippings collector, dry leaves collector, vacuum cleaner, carpet washer, floor waxer and wet
5 floor cleaner.
32. The two module appliance according to claim 12, wherein the at least one battery is a removable battery.
33. The power module according to claim 21, wherein the at least one battery is a removable battery.
- 10 34. A module appliance according to any of claims 1 - 33 substantially as illustrated in any of the drawings.
35. A module appliance according to any of claims 1 - 33 substantially as described hereinabove.

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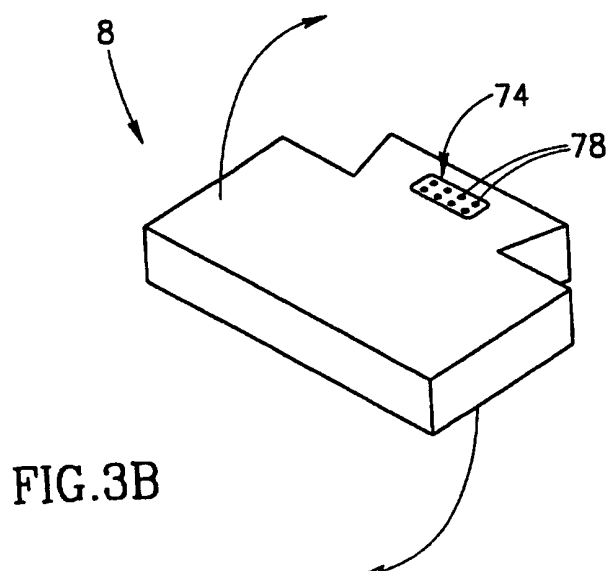
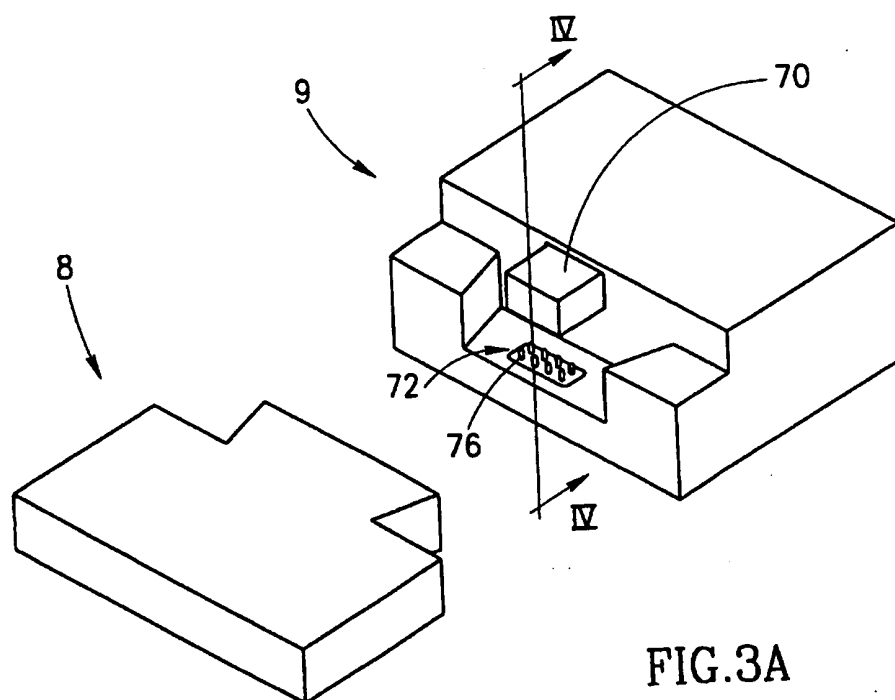
FIG. 1



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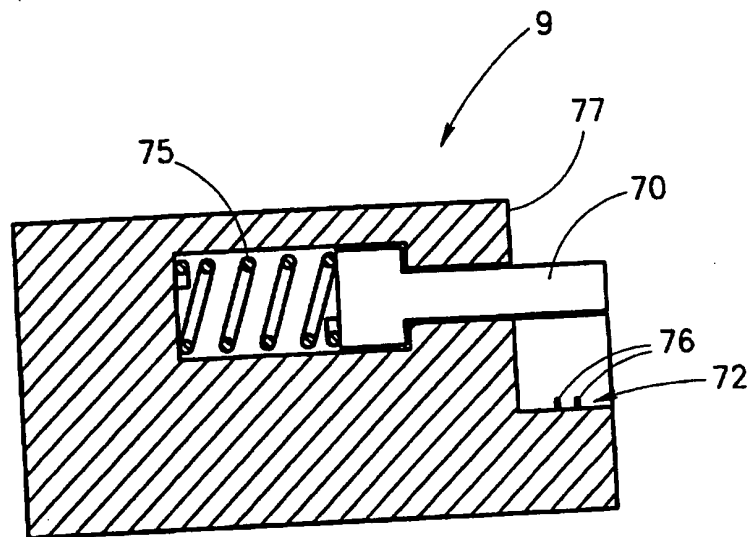


FIG. 4

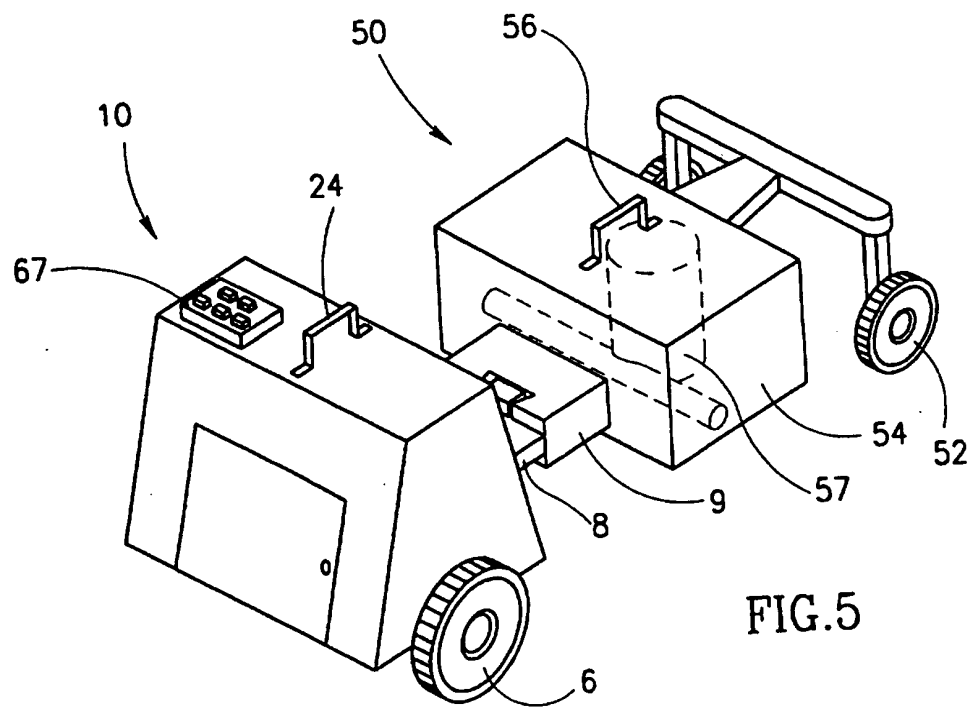
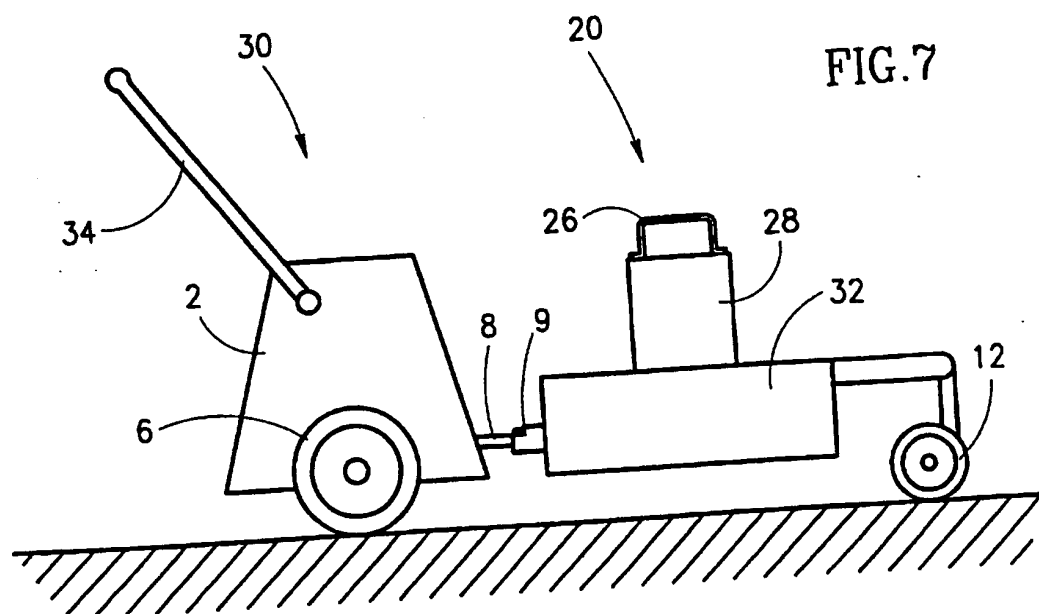
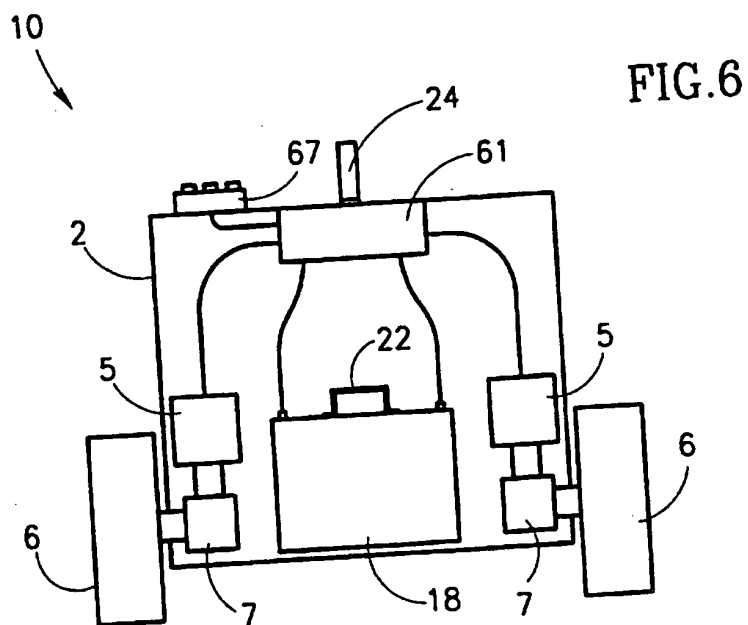


FIG. 5

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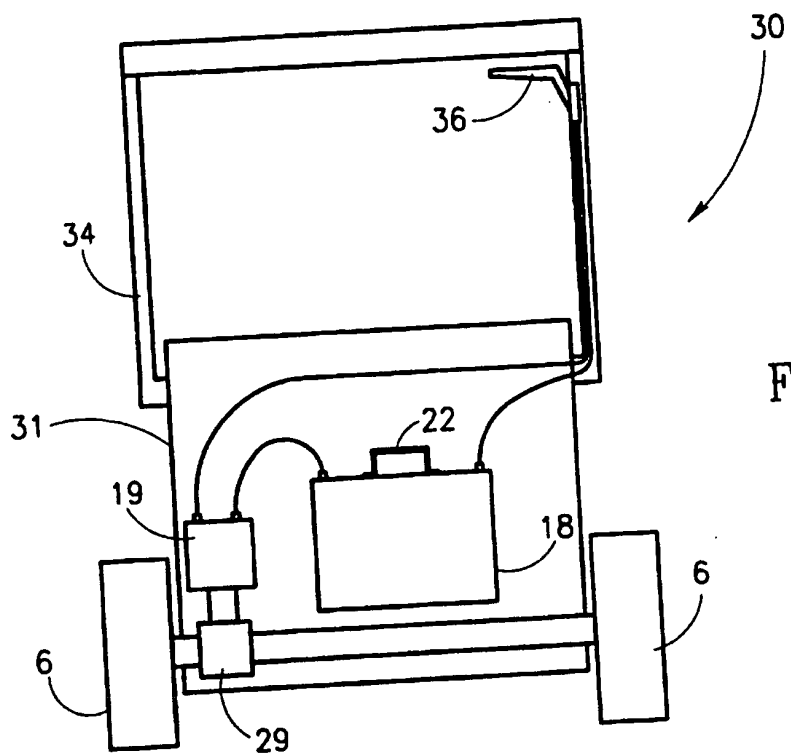


FIG. 8

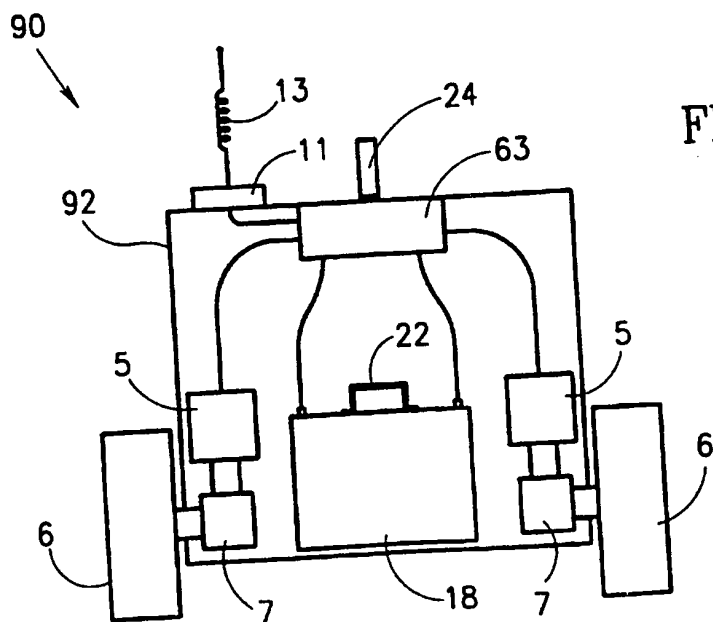


FIG. 9

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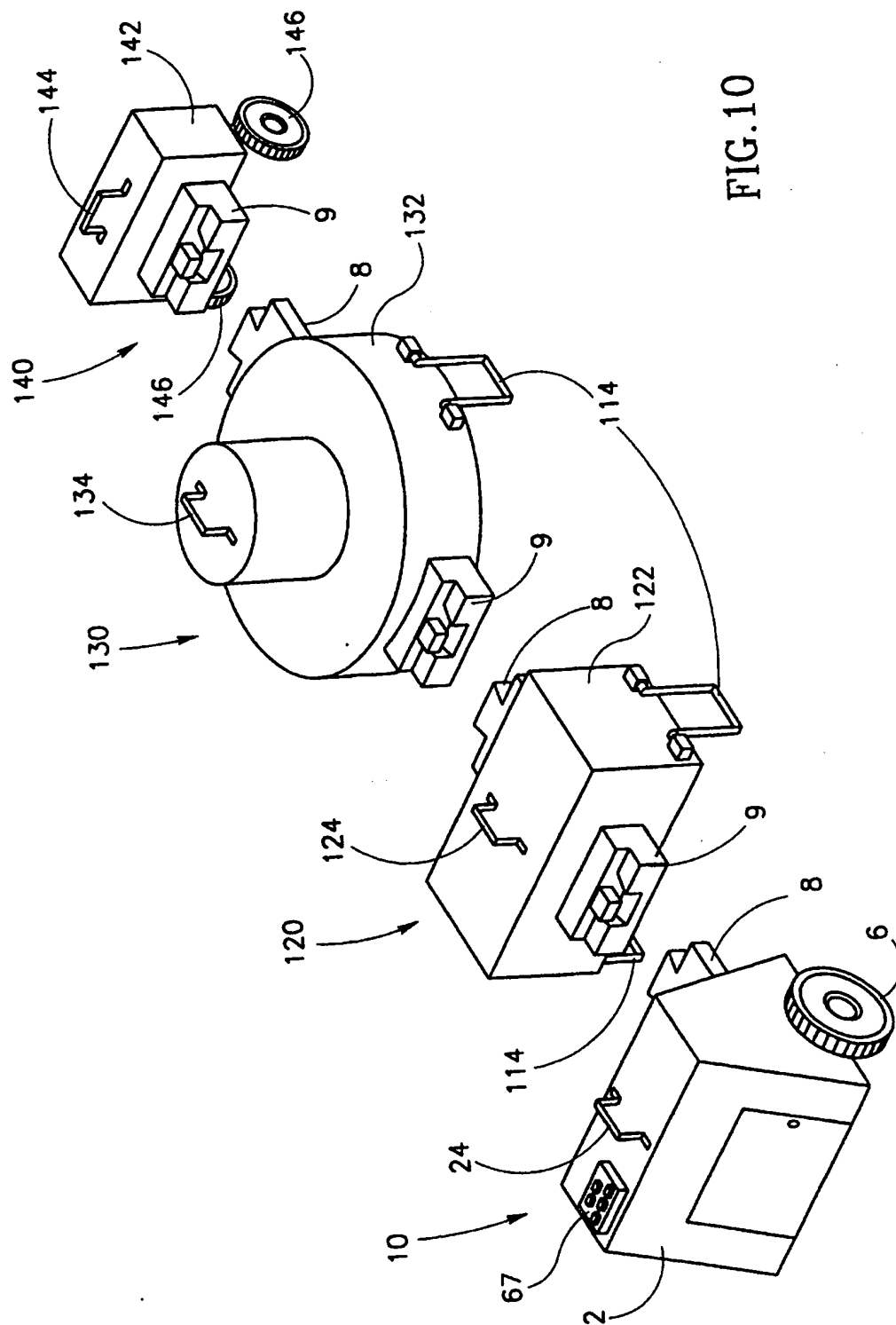


FIG.10

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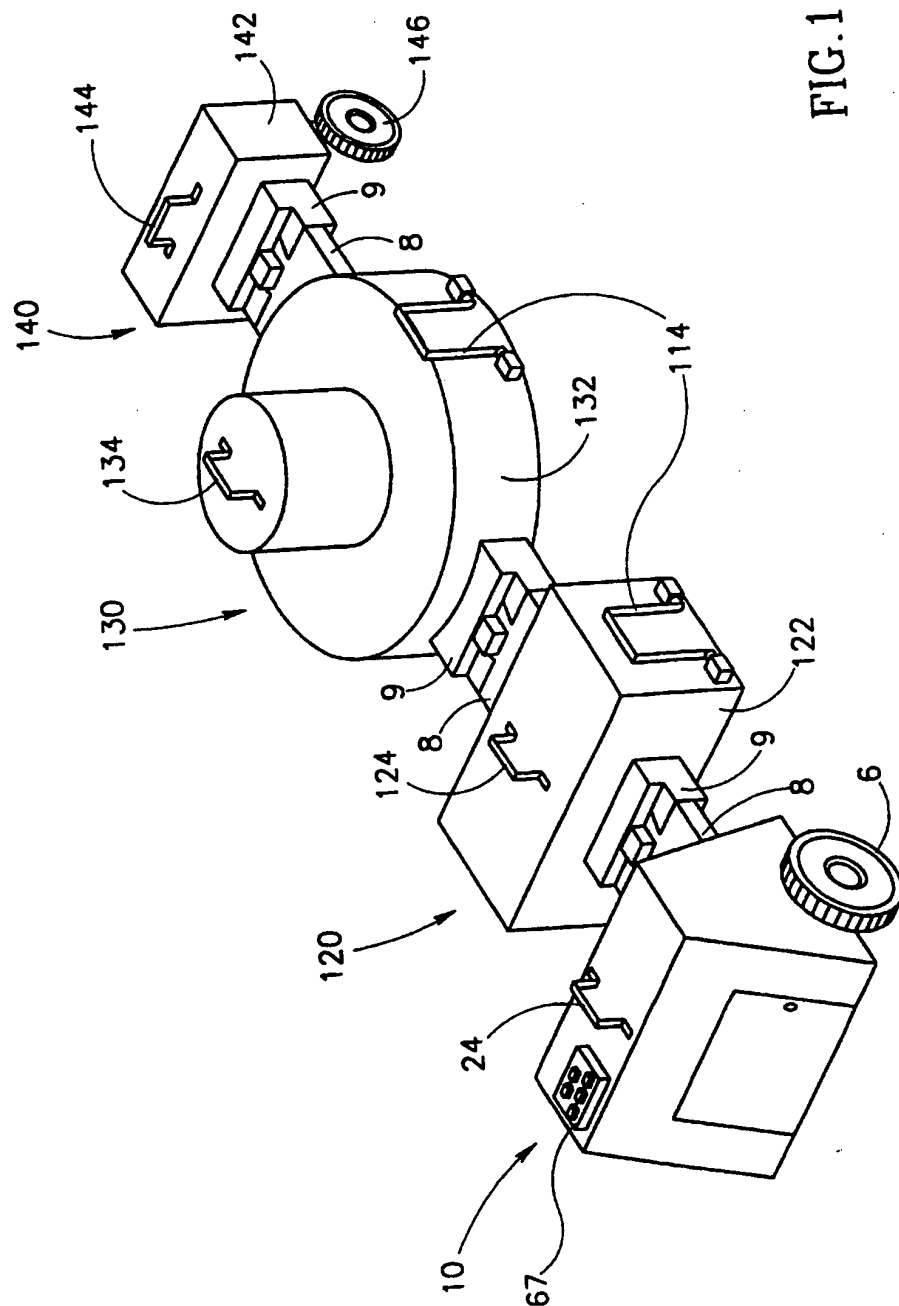


FIG.11

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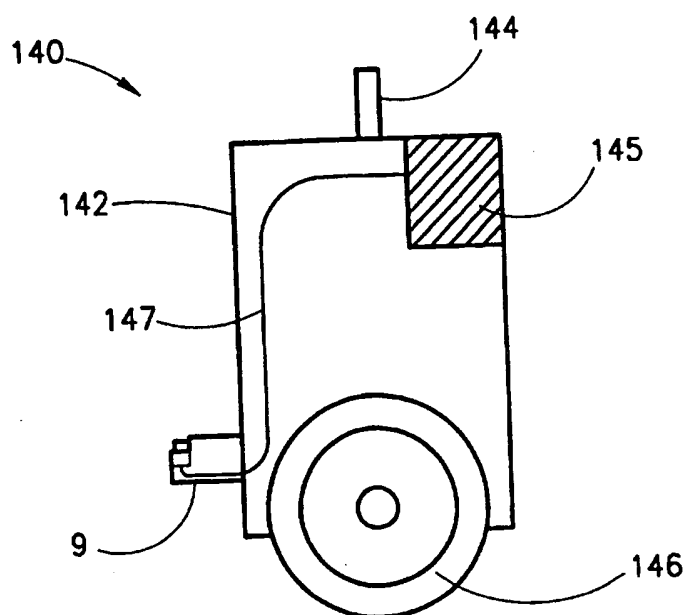


FIG.12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL97/00200

A. CLASSIFICATION OF SUBJECT MATTER														
IPC(6) :B25J 5/00 US CL :180/11; 901/1 According to International Patent Classification (IPC) or to both national classification and IPC														
B. FIELDS SEARCHED														
Minimum documentation searched (classification system followed by classification symbols) U.S. : 180/11, 15, 16; 901/1														
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched														
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)														
C. DOCUMENTS CONSIDERED TO BE RELEVANT														
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.												
X	US, 5,351,774 A (OKAMOTO) 04 October, 1994, see entire document.	12-15, 18-19, 21-24, 27-28, 32-33												
A	US 5,573,078 A (STRINGER et al.) 12 November 1996, see entire document.													
A	US 5,337,845 A (FOSTER et al.) 16 August 1994, see entire document.													
A	US 4,452,327 (MOWAT et al.) 05 June 1984, see entire document.													
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.														
<table border="0"> <tr> <td>* Special categories of cited documents:</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"E" earlier document published on or after the international filing date</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"A" document member of the same patent family</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td></td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"A" document member of the same patent family	"O" document referring to an oral disclosure, use, exhibition or other means		"P" document published prior to the international filing date but later than the priority date claimed	
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Date of the actual completion of the international search 04 SEPTEMBER 1997		Date of mailing of the international search report 26 SEP 1997												
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WO9749528

Biblio

Desc

Claims

Page 1

Drawing

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**MULTIPLE MODULE APPLIANCE**

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Publication date: 1997-12-31
Inventor(s): PELESS EHUD (IL); LEVIN SHALOM (IL)
Applicant(s): FRIENDLY MACHINES LTD (IL); PELESS EHUD (IL); LEVIN SHALOM (IL)
Requested Patent: ☐ WO9749528
Application Number: WO1997IL00200 19970618
Priority Number(s): IL19960118711 19960623
IPC Classification: B25J5/00
EC Classification: A01D34/00A, A47L11/40
Equivalents: AU3105097, ☐ EP0920367 (WO9749528), A4
Cited Documents: US5351774; US5573078; US5337845; US4452327

Abstract

A multiple module appliance for performing routine tasks in a work area is provided. In one embodiment, the appliance includes a power module (10), at least one task module (120), and a terminal module (140). The power module (10) is separable and includes at least one battery (18). The task module (120) is separable and performs a task. The task module (120), which includes a task deck (122) and apparatus for performing a task, is connectable in series between the power module (10) and the terminal module (140) and receives power from the power module (10). More than one task module can be connected in series between the power module and the terminal module.

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